PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Sensitive Electric Snap-switches

We, COMPAGNIE ELECTRO-MECANIQUE, a French Body Corporate, of 12, rue Portalis, Paris 8°, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention concerns a sensitive miniature-type electric snap-switch and is applicable to any similar circuit-breaking devices, such as, for example, reversing switches, change-over switches and micro-contactors, the aforesaid devices hereinafter being commonly called "micro-contacts".

These devices comprise at least one movable member carrying contacts which, by various mechanical means, are very rapidly transferred from one fixed contact or abutment to another fixed contact or abutment in order to open or close one or more electric circuits.

These "microcontacts" are generally connected to metal terminals, which are in turn connected to the load circuits. The internal connections to these terminals are effected by means of one or more metal members which are secured to insulating members.

Thus, a number of connections between these metal members, which are generally assembled by rivetting, welding or other mechanical methods, are inserted into the electric circuit, thereby adding variable contact resistances to the detriment of the quality of the circuit, resulting mainly from loosening of the points at which the conducting parts are assembled or from oxidation of the latter at their fixed contact points in the course of time.

In addition, the said conducting members do not always remain in the position in which they are initially gripped, rivetted or moulded, and they thus set up disturbances in the operation of the "microcontacts", which are precision devices. The necessary adjustment tolerances which are often added also impair the precision of the assembly.

According to the present invention there is provided a sensitive miniature-type electric snap-switch having an actuation mechanism with an elastic plate carrying movable contacts actuated by a push button, and a base and/or cover formed by insulating plates comprising conducting paths, obtained by any method of the printed-circuit, laminar-circuit or similar techniques, having surfaces for movable contacts and forming fixed contacts of the switch.

Four embodiments of the invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 illustrates a longitudinal section through a change-over "microcontact";

Figure 2 is an exploded view showing the various parts of the "microcontact" of Figure 1 in the order of their assembly;

Figure 3 is an example of the association of a number of "microcontacts" in a multipolar cicuit arrangement;

Figure 4 illustrates a constructional variant of switch, of which the base forms an integral part of a complete printed circuit;

Figure 5 is a plan view of the interior of the device of Figure 4, the base being omitted for clarity;

Figure 6 is a plan view of the printed circuit of the base;

Figure 7 illustrates a variant of the switch;

Figure 8 is a plan view of the interior of the device of Figure 7, of which the base has been removed;

Figure 9 is a plan view of the printed circuit of the latter base;

Figure 10 illustrates a variant of a switch,

of which the cover and base form an integral part of complete printed circuits;

Figure 11 is a plan view of the interior of the device of Figure 10, of which the base has been removed.

It is to be understood that in the following the nature of the circuit-breaking device is specified only by way of example and that any other breaking device may be substituted therefor.

In Figure 1, which illustrates a snap-action switch, the base plate 1 and the plate 2 forming the cover comprise on one of their faces conducting paths 3. The two plates consist of insulating material and may be absolutely identical and interchangeable or slightly different as indicated in the drawing.

In the case of a simple on-off switch, one of the two plates may be replaced by a simple insulating plate serving as an abutment for the moving contacts.

The conducting paths 3 situated on the surfaces of the plates are obtained by processes known in the printed circuit field or like techniques.

The external portions 4 of the conducting paths serve for the connection, for example by welding, to the external circuits to be controlled. The inner parts 5, which may or may not be thickened, serve as fixed contact zones co-operating with the movable contacts 6. The distance between the plates 1 and 2 determining the spacing of the two fixed contacts is obtained by an insulating spacing member 7.

The conducting paths, which are generally of small thickness, compatible with the manufacture of the conductor-insulating plates, may have a width or a surface compatible with the current density which is to flow through them.

The contact zones may be reinforced in thickness by means of known solutions for electrodeposition, metallisation or sublimation *in vacuo*, by the application of an appropriate conducting metal, such as, for example, silver, nickel, gold or alloys thereof. This metal may be of a different nature from the metal of the support, which is generally copper.

Further methods of reinforcing the contact zones, may be, for example, adding an inset of precious metals in the copper support.

Thus, the conducting parts of the plates 1 and 2 constitute both fixed contacts and connecting members, thereby obviating the assembly of various conducting parts.

The plates 1 and 2 with their spacing member 7 are disposed on an insulating securing base 8 which is formed with a central recess 9 to receive a spring 10. The latter enables an automatic re-setting to be obtained when the quick-acting actuation mechanism 11 has been designed with a single stable position, as illustrated in Figures 1 to 3.

A push button 12 provided with an insulating head 13 is provided to actuate the mechanism 11.

The assembly formed of the members 1, 2, 7 and 8 is centred and made fast by means of solid or tubular rivets 14 or by any other assembling device.

By omitting the spring 10, a device having two stable positions is obtained, the first of which positions is produced by pushing the button 13 and the second by retraction. This double stable position could also be obtained by the action of any external auxiliary device acting on the push button 12 in the two positions, with or without the use of the spring 10. The push button 12 in this case could be so arranged as to extend completely through the base, so that it may be acted on by an auxiliary device at each of its ends.

Figure 2 illustrates the simplicity of the parts and the readiness with which they can be assembled, as also the complete absence of mechanical connecting members in the electric circuit.

Figure 3 illustrates the readiness with which "micro-contacts" designed in accordance with the invention may be associated in a multi-contact stack having almost simultaneous triggering, a single external button being sufficient for actuating the whole assembly.

This quasi-simultaneity is improved in this design by the fact that the positioning tolerances of the metallic supports of the fixed contacts usually fixedly mounted on their insulating support by moulding or rivetting, for example, are economically eliminated, these supports here being replaced by a thin regular copper layer adhering to the insulating support and almost completely plane by reason of the tolerances usually necessary in the manufacture of so-called printed or laminar circuits. The spacing members 7 may thus bear directly on copper portions without harming the precision of the assembly.

In Figures 4 and 5, which illustrate an on-off "micro-contact", the upper plate and the spacing member of Figure 1 have been combined to form a single member 15, which is preferably moulded and which forms a cover in which a push button 16 (with or without a return spring 17) drives a quick-acting mechanism 11 provided with movable contacts 6.

The base plate 1 of Figure 1 with its printed circuit comprising conducting paths 3 and contact zones 5, which latter may be reinforced by the addition of appropriate precious metal, here forms an integral part of a larger printed circuit 18 embracing in accordance with Figure 6 connections associ-

ated with other electric devices, such as resistances, condensers, transistors, etc., not appearing in the drawing.

The movable contacts 6 have a predetermined inter-axial distance *a* corresponding to an identical distance *a'* between the contact zones 5 of the printed circuit of Figure 6, with which they co-operate when they are applied to and assembled on the said printed circuit by means of fixing members 19 which may or may not form part of the cover 15 and of which the inter-axial distance *b* corresponds to that *b'* between the fixing holes 20 which are provided for this purpose in the support of the printed circuit 18. By way of example, the said fixing means are insulating or metallic resilient clips which lock the "microcontact" to the printed circuit. Any other appropriate fixing or locking device may of course be used.

In this construction according to Figures 4 to 6, the movable assembly 16, 17, 6 is maintained in position by anchoring the stem 21 of the mechanism 11 in slots 22 in the push button 16, even in the absence of any fixed contact or support.

The aforesaid arrangement has the advantage of enabling a "microcontact" to be fitted at the time of the assembly of the complete printed circuit, which minimises the means required to connect the "microcontact" in its circuit and the corresponding parasitic resistances, so that the number of parts required is reduced. The mounting of the "microcontacts" is rapid and economic and the replacement or removal of the devices in the event of damage or necessity is greatly facilitated.

The precision of the positioning of the "microcontact" may where necessary be ensured by means of centring studs 23 having inter-axial distances *c* and *d* corresponding to those *c'* and *d'* between the holes 24 of precise diameter and position, provided for this purpose in the support of the printed circuit 18.

A variant of the foregoing construction is illustrated in Figures 7 to 9. In this variant, the cover may be either a moulded member 25 of appropriate shape, by virtue of which it can receive on its inner profile a conducting coating 26, or formed from a thermo-plastic sheet covered with a conducting coating.

The conducting coating may be a copper strip which has been cut out, shaped and where necessary stuck, or a part of a flexible printed circuit of the type which is commercially obtainable, which is in turn stuck, for example, to the casing, or again a conducting deposit obtained by metallisation or a known chemical or electrolytic process. The said metallic part, which may be reinforced at the location of the contacts by a special metal deposit, as already indicated in the foregoing, comes into contact with appropriate connections 27 provided for this purpose on the printed circuit, which are sufficiently wide to ensure good mechanical and conducting seating of the "microcontact". The printed circuit also comprises contact zones on which the movable contacts 6 of the switch may bear. The pressure necessary for the contacts between the conducting coating 26 and the connections 27 of the printed circuit is provided by the securing system of the "microcontact": resilient clips 19 or any other device for fixing or locking the "microcontact" on the support of the printed circuit.

There may also be provided in the cover 25 centring studs 23, to which there correspond holes 24 in the support of the printed circuit, whereby precision of assembly is ensured.

A last example of a "microcontact" in which both the base and the cover of the apparatus form an integral part of complete printed circuits 18 and 28 is illustrated in Figures 10 and 11.

Spacing means is inserted between the two printed circuit supports. The distance between these two supports, which determines the contact spacing of the two circuits, is obtained by means of an annular insulating spacing member 29 provided with studs 30 which engage in holes 31 provided for this purpose in the printed circuit supports.

In a modified form, as indicated in the right-hand part of Figure 11, this annular insulating spacing member may be replaced by metal spacing members 32 of which the ends engaged in the holes in the printed circuit supports permit, for example, the introduction of compression rivets (not shown in the drawing), the spacing members then performing the function of the assembly members of the printed circuits. Of course, any other known method of assembly may be envisaged.

As in the case of the example of Figure 1, the push member 16 of the "microcontact" in the other examples may or may not be provided with a spring 17. It may also be actuated by an auxiliary external member acting, for example, as a "press-pull" member on one side only or as a "press" member on both sides, the rod of the push member then extending through the base of the apparatus.

Likewise, multipolar arrangements may be provided by stacking the "microcontacts" vertically with the inter-position of appropriate spacing members, the combined apparatus being controlled by the action of a single push member.

A combination of "microcontacts" in a horizontal plane may also be envisaged, as diagrammatically indicated in Figure 6, if desired with a single control, the push buttons being connected by an appropriate connecting means.

In the foregoing examples, the "micro-

contacts" illustrated comprise two movable contacts. It is also possible to envisage the use of apparatus comprising a single movable contact with the blades of the actuation mechanism fixed at one end.

The "microcontacts" according to the invention may also be mounted and assembled in other combined forms without departing from the scope of the invention as defined by the appendant claims.

WHAT WE CLAIM IS:—

1. A sensitive miniature-type electric snap-switch having an actuation mechanism with an elastic plate carrying movable contacts actuated by a push button, and a base and/or cover formed by insulating plates comprising conducting paths, obtained by any method of the printed-circuit, laminar-circuit or similar techniques, having surfaces for movable contacts and forming fixed contacts of the switch.

2. A sensitive miniature-type electric snap-switch according to claim 1 wherein the base and the cover are plates.

3. A sensitive miniature-type electric snap-switch according to claims 1 or 2 wherein an insulating spacing member is disposed between the base and the cover and rests on the conducting paths.

4. A sensitive miniature-type electric snap-switch according to claims 1 or 2 wherein a metal spacing member is disposed between the base and the cover and does not rest on the conducting paths.

5. A sensitive miniature-type electric snap-switch according to Claims 3 or 4 wherein the spacing member is of continuous outline.

6. A sensitive miniature-type electric snap-switch according to claims 1 or 2 wherein insulated metal spacing members are disposed between the base and the cover.

7. A sensitive miniature-type electric snap-switch according to claims 4 or 6 wherein the metal spacing members serve as members for the assembly between the base and the cover.

8. A sensitive miniature-type electric snap-switch according to claims 2 to 7 wherein the thickness of the spacing member determines the spacing of the base and cover.

9. A sensitive miniature-type electric snap-switch according to any of the preceding claims wherein the said cover and/or base of the switch are part of a support for a printed or similar circuit which extends outside the switch.

10. A sensitive miniature-type electric snap-switch according to claim 1 wherein the conducting paths of the said cover or base cooperate with corresponding conducting parts of the said printed or similar circuits.

11. A sensitive miniature-type electric snap-switch according to any of the preceding claims having means for facilitating the exact assembly of the switch.

12. A sensitive miniature-type electric snap-switch according to claim 11 wherein the said cover and base are assembled with the aid of connecting and locking elements, studs being optionally provided in one and corresponding holes in the other to permit centring of the assembly.

13. A sensitive miniature-type electric snap-switch according to any of the preceding claims in which the conducting paths are reinforced by the addition of a suitable metal at points which are used as the fixed contacts of the switch.

14. A switching device comprising snap-switches according to any of the preceding claims vertically stacked and simultaneously controlled by an external push button at one or both ends of the device.

15. A switching device comprising snap-switches according to any of the preceding claims assembled horizontally.

16. A sensitive miniature-type electric snap-switch substantially as herein described with reference to and as illustrated in Figures 1 and 2, Figures 4, 5 and 6, Figures 7, 8 and 9 and Figures 10 and 11 of the accompanying drawings.

17. A switching device substantially as herein described with reference to and as illustrated in Figure 3 of the accompanying drawings.

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Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

Fig:1

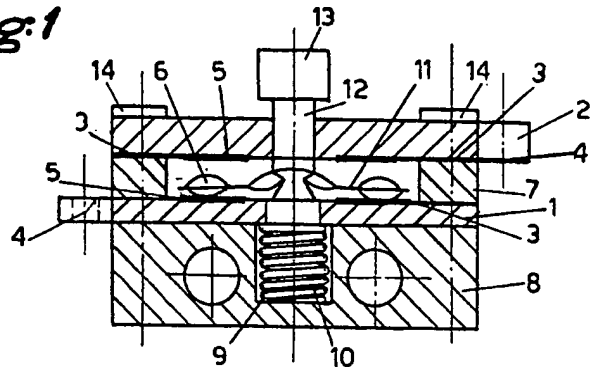


Fig:3

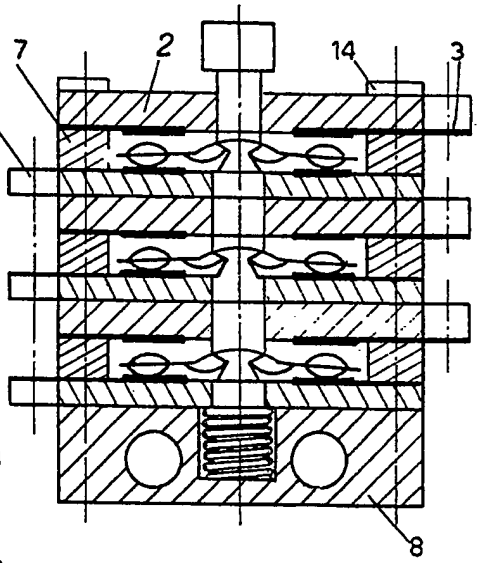
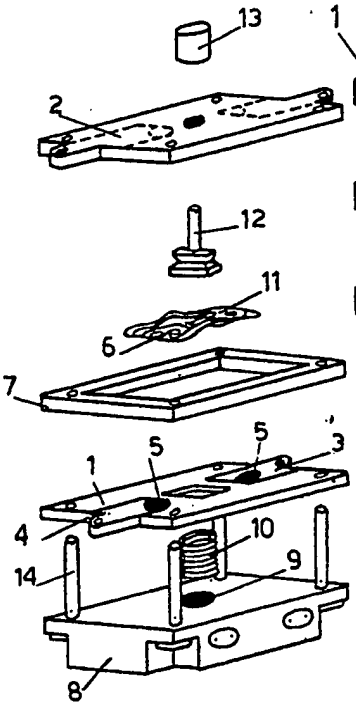


Fig:2



1,060,305 COMPLETE SPECIFICATION
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SHEETS 1 & 2

Fig:4

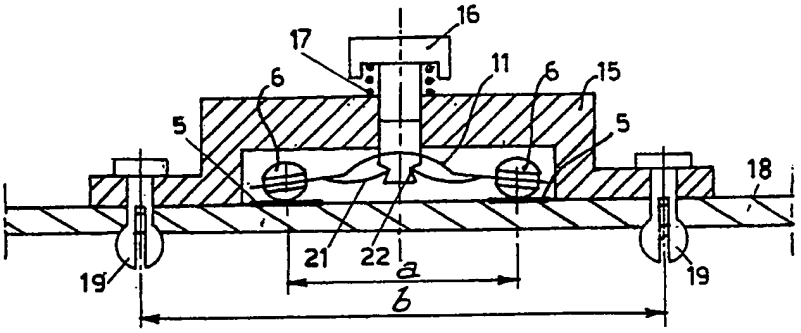
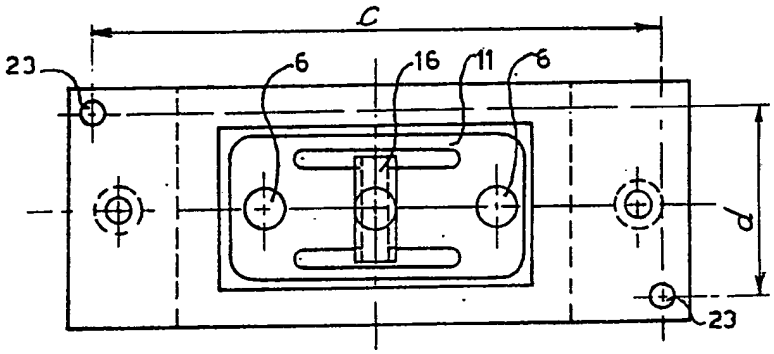


Fig:5



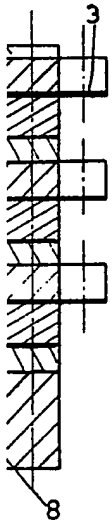
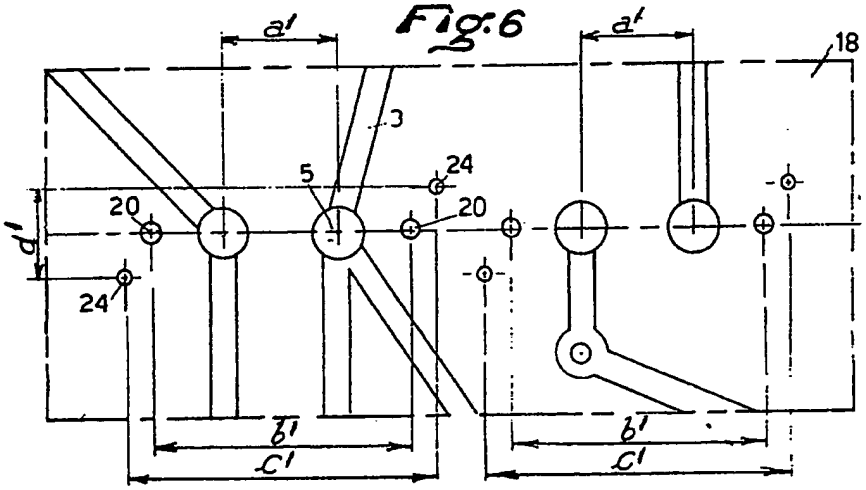


Fig:6



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SHEETS 1 & 2

Fig:1

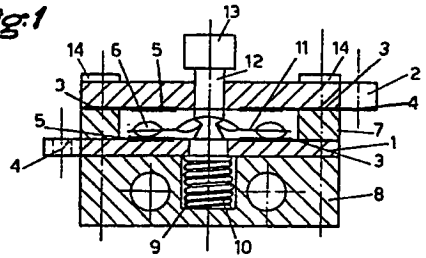


Fig:2

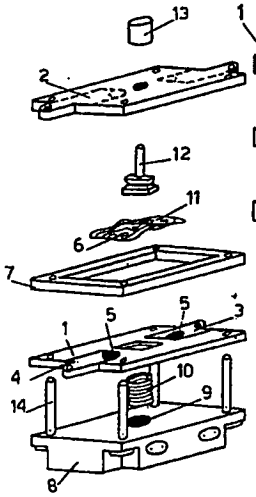


Fig:3

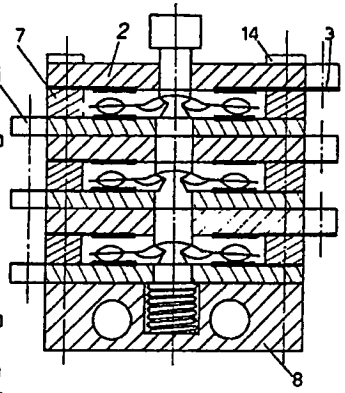


Fig:4

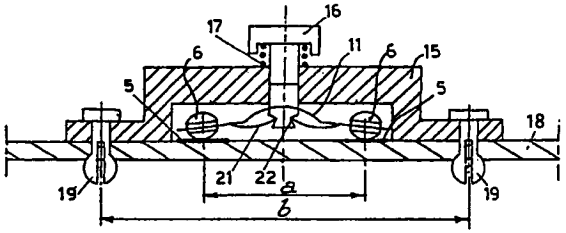


Fig:5

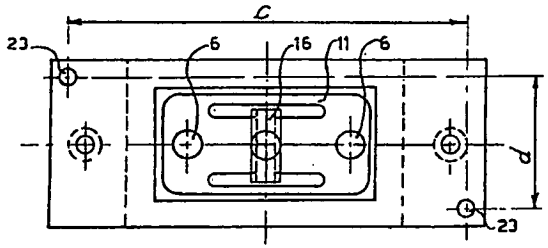


Fig:6

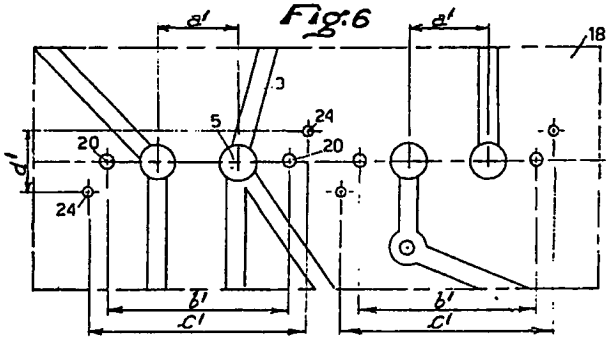


Fig: 7

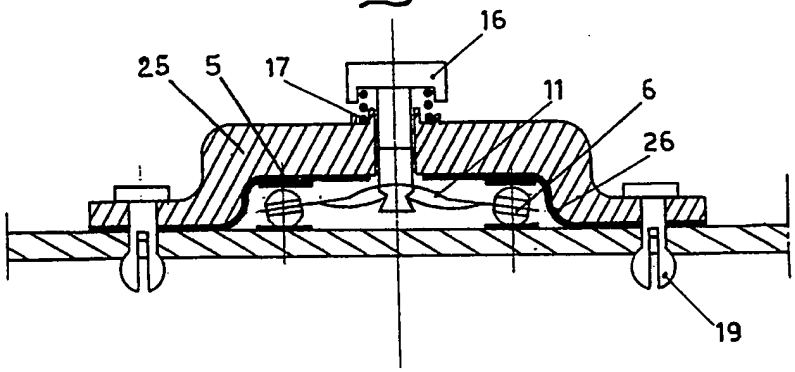


Fig: 8

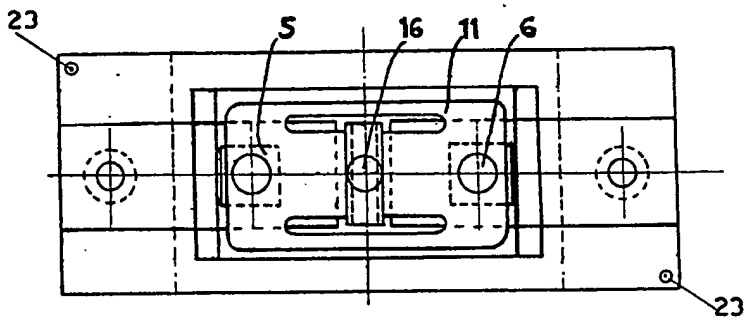
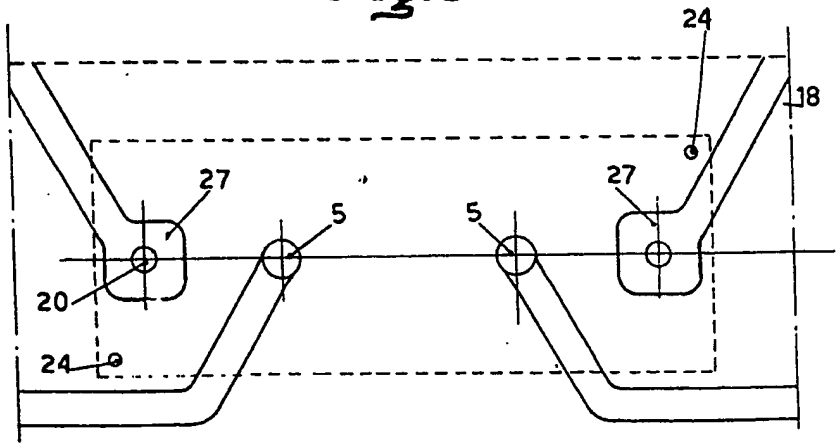


Fig: 9



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SHEETS 3 & 4

Fig. 10

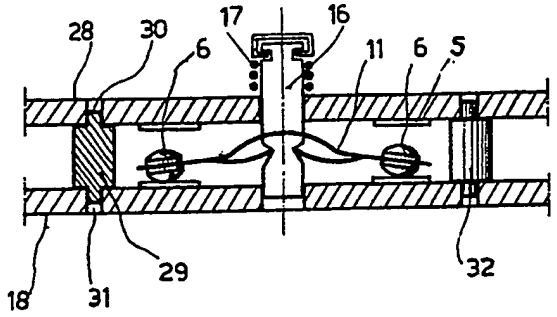
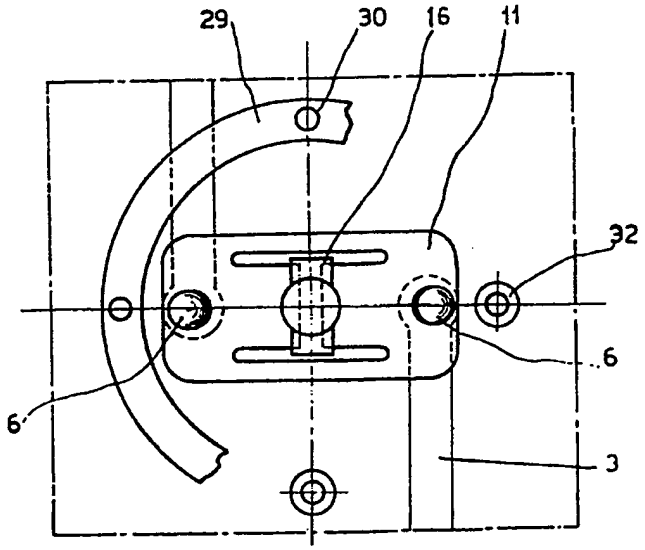


Fig. 11



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SHEETS 3 & 4

Fig: 7

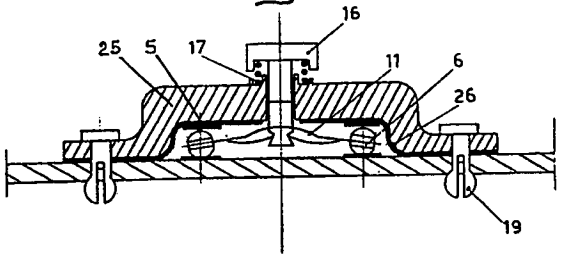

Fig: 8

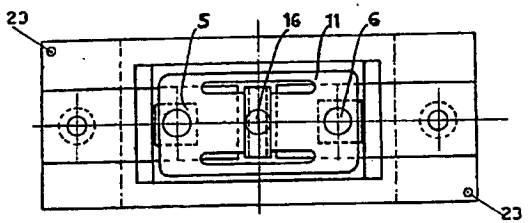

Fig: 9

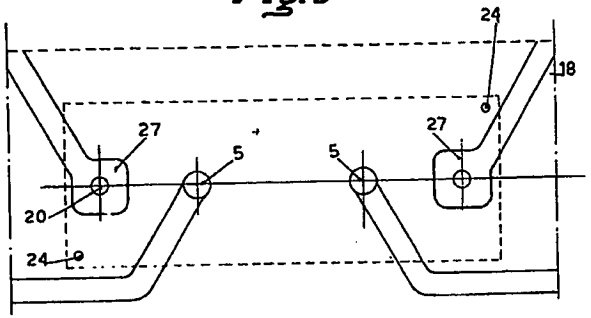

Fig: 10

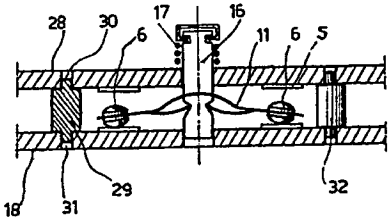

Fig: 11